Signor G. F. Mazzarelli contributes some researches on the morphology and physiology of the glands of Bohadsch in the Aplysiidæ (the opaline gland of Vayssière). He also gives the diagnosis of a new species of Aplysia. The author gives an elaborate histological description of the organ illustrated by two coloured plates, and amongst other conclusions shows that three liquids are secreted—a white odoriferous, a violet, and a mucous—which he declares to have an important biological value, and to concur with the secretions of the mantle for the defence of the animal.

Dr. N. Terracciano in a note on some plants of the flora of Terra de Lavoro describes several species so far not met with in that district, others not included in the Italian flora, and some new species and varieties. Figures are given of *Arabis surculosa*, *Amaranthus crispus*, and *Kœleria collina*.

Next follows a monograph of the fossil Pristis, with a description of a new species (*Pristis lyceenis*) from the Miocene limestone of Lecce, and of course figured.

Dr. L. Manfredi has an interesting paper on the contamination of the street surface of large cities, from a hygienic and sanitary engineer's point of view, with special reference to Naples. Sweepings of the streets were made at 9 a.m.—that is, after the regular cleansing had been performed, so that the materials collected represented what remains all the day to contaminate the air and whatever objects it comes in contact with. The materials, collected with all due precautions, were submitted to bacteriological and chemical analysis. One gramme of fresh sweepings contains from 910·000 to 668,000,000 vital or living bacteria, or double the amount found in fresh fœces, or about 1319 times richer than drain water. Compared with the streets of Munich we find that the author there found 8000 to 12,840,000. He demonstrates that, so far as Naples goes, the more cleanly kept are the streets the lower is the number of bacteria in their sweepings, whilst they or their spores have great resisting powers to heat, sunlight, and desiccation. They are most abundant in the temperate seasons of spring and autumn; small rains increase them, torrents markedly diminish them. The Schizomycetes are the predominant type, but ferments and moulds are common. The chemical examination is equally interesting, and, as the author shows, the material is a most favourable culture medium for micro-organisms; which research leads up to a series of experiments to show how the number of these increase up to a certain date and then diminish in a given sample of sweepings; the effects of rain in facilitating this growth are demonstrated, and also the gases given off as the result of such changes.

The inoculation experiments are also not without interest. An examination of the sub-soil on the same lines is of great importance, and several practical and important conclusions are drawn from these researches, which the limits of space forbid our more fully reviewing. The memoir is one that should be consulted by every municipal officer.

Signor G. F. Mazzarelli has another long paper on the morphology and physiology of his favourite Aplysiæ of the Gulf of Naples, and illustrated by four plates.

Altogether this volume does credit to the Academy, but one regrets not to see papers by some more of its members.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—In a Convocation held on June 7, the thanks of the University were ordered to be conveyed to Mr. C. D. E. Fortnum, Hon. D.C.L., for his munificent gift to the Ashmolean Museum, and an indenture was sealed, the provisions of which place the Ashmolean Museum on an entirely new footing.

In the year 1888 Dr. Fortnum gave to the University a large portion of his collection of antiquities and works of art, which had been exhibited on loan in the upper room of the Ashmolean Museum. Dr. Fortnum has now notified his intention of bequeathing to the University the remainder of his collection together with his library, and he has undertaken to transfer to the University a sum of £10,000 on certain conditions, the main object of which is to provide for the care and maintenance of the Museum in the future. Under the indenture, which was signed on Tuesday last, the University is bound—

(1) To provide a sum, not exceeding £11,000, for the erection of a new Ashmolean Museum, on ground adjoining the University Galleries.

(2) To provide a sum, not exceeding £4000, for the fitting up and furnishing the Museum.

(3) To augment to £600 a year, at least, the income arising from Dr. Fortnum's benefaction of £10,000.

Dr. Fortnum's kindly intentions to the new Ashmolean Museum include a further bequest to the University of £5000 contingent upon the University voting the £15,000 for buildings, fitting, and furniture. With regard to this amount the University authorities make the following remark:—"Of the £11,000 required for the building, it appears that the Curators of the University Chest will have funds in hand in the course of this year and next, out of which this expenditure may be defrayed. It is right, however, to state that this will leave the University Chest for the present without further resources, in the form either of stock or of cash, for meeting any other new expenditure upon a large scale."

It is proposed that the old Ashmolean Museum, when no longer required for its present purpose, shall be available as an extension for the Bodleian Library, for which additional accommodation must have soon been provided.

The University Observatory.—The annual meeting of the Board of Visitors took place on Wednesday, June 8, when the Savilian Professor (Rev. C. Pritchard, D.D., F.R.S.) read his annual report. After remarking on the present condition of the buildings and instruments, the Professor said:—

"As anticipated in the last report, the work connected with stellar parallax is now complete, and I have placed upon the table a manuscript containing the result of that research. I need hardly say that it has been a work of unremitting labour, and one which has occupied the strenuous efforts of myself and the Observatory staff during the last four years. The manuscript thus completed consists of (1) the concise but complete history of all effective researches in stellar parallax up to the present date; (2) the results of the parallax work completed in this Observatory, extending on the whole to some thirty stars; (3) a catalogue of all parallactic determinations effected by other astronomers.

"The provision of photometric catalogues of stars of the ninth and eleventh magnitudes, within small specified areas for the use of the eighteen Observatories engaged on the international chart of the heavens, has been effected, and the results distributed through the agency of the Paris Observatory. The cause of this proceeding originated in the unsuccessful attempts to secure the required uniformity of stellar magnitude on the photographic plates by the employment of metallic gauze screens of one definite mesh. Much time was consumed on the experimental research into the action of such screens on the photographic image, and in the course of the inquiry certain unexpected and interesting results came to light, the substance of which I communicated to the Paris Academy, and which were subsequently published in the Transactions of that body. It is satisfactory to find that these photometric determinations have been appreciated and found to be of practical service, and have been acknowledged as such by both the Directors of the Greenwich and Paris Observatories.

"Notwithstanding these very serious interruptions, considerable progress has been made in securing the photographic plates for the international chart and catalogue. In number these plates amount to about 150, and it is hoped in future they will accumulate more rapidly, since the work on the preparation of these aforementioned photometric catalogues is now complete."

The report concludes with the usual acknowledgments to the assistants, and with this very satisfactory expression, on which we beg to congratulate the Savilian Professor—"The state of my health and other circumstances prevented my being present at the last meeting of the Board, but I am glad to say that the anticipation of the speedy and complete recovery, mentioned in the last report, has been fully realized."

Radcliffe Travelling Fellowship.—The Examiners for this Fellowship give notice that a Fellowship is thrown open this year to all persons who have been placed in the First Class in the School of Natural Science, without further restriction. The examination will be as far as possible in the subjects specified by the candidates who offer themselves for examination, and will take place in the first week in November.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 19.—"On the Measurement of the Magnetic Properties of Iron." By Thomas Gray, B.Sc., F.R.S.E. Communicated by Lord Kelvin, P.R.S.

This paper gives the method of experiment and results obtained in some investigations on the time-rate of rise of current in a circuit having large electromagnetic inertia. The experiments were made on a circuit containing the coils of a large electromagnet having laminated cores and pole pieces. The mean length of the iron circuit was about 250 cm., and its cross section 320 sq. cm. The magnetizing coil had 3840 turns, when all joined in series, and a resistance of 10·4 ohms. The coils were so arranged that they could be joined in a variety of ways so as to vary the resistance, inductive coefficient, &c., and also to allow the magnet to be used either as an open or a closed circuit transformer.

The electromotive force used in the experiments was obtained from a storage battery, and the method of experiment was to trace the curve, giving the relation of current to time, on a cronograph sheet.

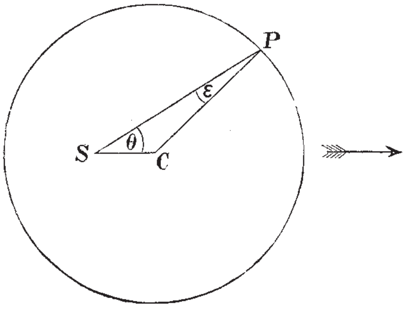
One set of experiments shows the effect of varying the impressed E.M.F. on the time required for the current to attain any given percentage of its maximum strength. The results show that for any particular percentage there is always a particular E.M.F. which takes maximum time. Thus for the circuit under consideration, and with successive repetitions of the current in the same direction, it takes longer time for the current produced by an impressed E.M.F. of 4 volts to reach 95 per cent. of its maximum than it takes for the current produced by either 3 or 5 volts to reach 95 per cent. of their maximum. The results show also that, within considerable limits, the time required for the current to become uniform is on the whole nearly inversely proportional to the impressed E.M.F., and that for moderate values of the E.M.F. the time may be very great; when the E.M.F. was 2 volts, and the current sent in such a direction as to reverse the magnetism left in the magnet by a previous current of the same strength, the time required for the current to establish itself was over three minutes. The difference of time required for repetition and for reversal of previous magnetization was also very marked when the iron circuit was closed. The results show that great errors may arise by the use of ballistic methods of experiment, especially when weak currents are used, and that for testing resistances of circuits containing electromagnets, a saving of time may be obtained by using a battery of considerable E.M.F.

Another set of experiments gives the effect of successive reversals of the impressed E.M.F. at sufficient intervals apart to allow the magnetization to be established in each direction before reversal began. In this set also the effect of cutting out the battery and leaving the magnet circuit closed is illustrated, showing that several minutes may be required for the magnet to lose its magnetism by dissipation of energy in the magnetizing coil. The effect on these cycles of leaving an air space in the iron circuit is also illustrated. It is shown that a comparatively small air space nearly eliminates the residual magnetism, and diminishes considerably the rate of variation of the coefficient of induction and the dissipation of energy in the magnet.

Several cycles are shown for the magnet used as a transformer with different loads on the secondary. The results give evidence that there is less energy dissipated in the iron the greater the load on the secondary of the transformer.

Some experiments are also quoted which go to show that the dissipation of energy due to magnetic retentiveness (magnetic hysteresis) is simply proportional to the total induction produced when the measurements are made by kinetic methods. Reference is made to the recent experiments of Alexander Siemens and others which seem to confirm this view.

Physical Society, May 27.—Mr. Walter Baily, Vice-President, in the chair.—The following communication was read:—On the present state of our knowledge of the connection between ether and matter: an historical summary, by Prof. O. J. Lodge, F.R.S. Referring to difficulties connected with the aberration of light, if the medium were supposed to be carried along by the earth in its orbit, Dr. Lodge described Boscovich's suggested experiment with a telescope filled with water, carried out by Klinkerfues, who was led to conclude that the aberration constant depended on the medium within the telescope. Klinkerfues's experiments were repeated by Sir G. B. Airy, but not confirmed. Astronomical observations were not necessary to determine the point at issue, for a fixed source near a collimator might be used with advantage. Hoek had examined the subject in this way with similar negative results. It might therefore be concluded that surveying operations are unaffected by terrestrial motion. This result, however, did not prove the existence or non-existence of an ether drift relative to the earth, for, since the source and receiver move together, any effect produced by such a drift would be compensated by aberration due to motion of the receiver. Speaking of refraction, he pointed out that, if the ether were stationary in space, glass and other terrestrial bodies would have ether streaming through them, and that the refraction of, say, glass might differ as the direction of the ether drift through it varied. To test this, Arago placed an achromatic prism over the object-glass of a telescope on a mural circle, and observed the altitude of stars. To vary the direction of the ether drift through the prisms, stars in different azimuths were observed; but the results showed no appreciable change in the deviation produced by the prism due to direction of the earth's motion. Maxwell used a spectroscope to test the same point. Light from illuminated cross wires passed through the telescope, prisms and collimator, and was reflected back along the same path by a mirror and viewed through the telescope. Observations made with different aspects of instrument showed no change in the relative positions of the wires and their images. Mascart had also tried the experiment with simpler apparatus, but was unable to detect any change. These observations naturally suggest that the ether is at rest relative to the earth, but the apparently simple nature of aberration makes this view difficult to hold. Both phenomena are consistent with Fresnel's hypothesis that only the excess of ether, which the substance possesses over that of surrounding space, moves with the body, for on this supposition the effects of altered refraction and ether drift compensate each other. Fresnel's view is practically established by Fizeau's well-known experiment on the effect of moving water on the velocity of light, and by the more accurate numerical results obtained by Michelson. The only other theory which accounts for the experimental results is one by Prof. J. J. Thomson, which requires that the velocity of light in Fizeau's experiment should be altered by half the velocity of the medium. For media whose refractive indices are $\sqrt{2}$, the two theories lead to the same result, and as the indices of substances such as water do not differ much from this value, it is difficult to discriminate between them. Looked at in another way, Fizeau's experiment raises a difficulty, for, as Dr. Lodge pointed out, all water is moving with the earth, hence light should be hurried or hindered according to the direction in which it passes through the water. This effect doubtless exists, but the results of it have never been detected by experiment. It is therefore necessary to inquire why the effect could not be observed directly, for the experiment had been tried with interference apparatus by Babinet, Hoek, Jamin, and Mascart, and in no case was any effect observed. It would therefore seem as if the ether must be stagnant, *i.e.* stationary relative to the earth. Mascart had also tested whether Newton's rings, or the rotary power of quartz, were affected by ether drift, but with negative results. These observations are, however, likewise compatible with Fresnel's hypothesis of an ether fixed relative to matter, and a free ether of space permeating all substances, for, according to this view, there is no more motion of the ether in water or glass than in air; hence the time of journey round a closed contour is independent of the direction in which the light traverses that contour. The time of journey between two points is also unaffected by terrestrial motion, as was proved by the experiments of Babinet, Hoek, and Mascart on interference; hence he (Dr. Lodge) inferred that ether was either stagnant or had a velocity potential. In moving ether it was necessary to define a ray, and Lorentz's method is the best. Suppose CP represents the velocity of light (V) in still ether, and SC the velocity of the ether (v), then a disturbance originating at S will travel along SP, which is the



direction of the ray, whilst CP is the wave normal. In the above figure,

$$\frac{\sin\epsilon}{\sin\theta} = \frac{\mathrm{SC}}{\mathrm{CP}} = \frac{v}{\mathrm{V}} = \alpha, \text{ the constant of aberration.}$$

The velocity along the path of the ray is SP. Calling this velocity V′, we have

$$\mathrm{V}' = \mathrm{V}\cos\epsilon + v\cos\theta.$$

The path of a ray is determined by the time of journey being a minimum, and the formula

$$\mathrm{T} = \int_{\mathrm{A}}^{\mathrm{B}} \frac{ds}{\mathrm{V}} = \text{a minimum,}$$

is the equation to a ray, where A and B are the extremities, and *ds* an element of the path. If the ether be moving, V′ must be substituted for V, and we get—

$$\mathrm{T}' = \int_{\mathrm{A}}^{\mathrm{B}} \frac{ds}{\mathrm{V}\cos\epsilon + v\cos\theta} = \text{a minimum.}$$

This integral can be written exactly—

$$\mathrm{T}' = \int \frac{ds}{\mathrm{V}}\,\frac{\cos\theta}{1-\alpha^2} - \int \frac{v\cos\theta}{\mathrm{V}^2(1-\alpha^2)}ds$$
$$= \frac{\mathrm{T}\cos\theta}{1-\alpha^2} - \int \frac{v}{\mathrm{V}^2}\cdot\frac{\cos\theta}{1-\alpha^2}\,.\,ds.$$

The last term is the only one involving the first power of ether drift, and it vanishes in case there is a velocity potential; for, since $v\cos\theta = \frac{d\phi}{ds}$, where ϕ is the velocity potential, it may be written $\frac{\phi_{\mathrm{B}} - \phi_{\mathrm{A}}}{\mathrm{V}^2(1-\alpha^2)}$; and so its value depends only on the end points and not on the path. If these points are the same, *i.e.* the contour is closed, it becomes zero, and reconciles all the experiments hitherto made. It must be admitted, however, that if α is not a constant, the question is again opened, but there is no reason to suppose it can vary in the same horizontal plane. If the medium be changed, V becomes $\frac{\mathrm{V}}{\mu}$, and, in order to retain the same velocity potential in the changed medium, v must become $\frac{v}{\mu^2}$, which is Fresnel's law. Hence Prof. Lodge pointed out that the velocity potential condition includes Fresnel's law as a special case. It can, in general, be inferred that *no first order optical effect due to terrestrial motion can exist in a detectable form.* It is always compensated by something else. Quantities of the second order of magnitude must, therefore, be attended to. From the first equation above, it follows that

$$\cos\epsilon = \sqrt{1-\alpha^2\sin^2\theta},$$

and the time of journey in moving ether is given by

$$\mathrm{T}' = \mathrm{T}\frac{\sqrt{1-\alpha^2\sin^2\theta}}{1-\alpha^2},$$

where T is the time if everything were stationary. This is, in brief, the theory of Michelson's recent experiment. If the light travels along the ether drift, $\theta = 0$ and $\mathrm{T}_1 = \frac{\mathrm{T}}{1-\alpha^2}$; whilst if $\theta = 90°$, $\mathrm{T}' = \frac{\mathrm{T}}{\sqrt{1-\alpha^2}}$. Therefore the velocity along the ether drift should differ from that across the drift in the ratio of $\sqrt{1-\alpha^2} : 1$. This point has been very carefully tested by Michelson, but nothing approaching to a quarter of the theoretical effect was observed. His negative result would seem to preclude any relative motion, even irrotational, and shows that the ether is at rest relative to the earth's surface. On the other hand, the author (Dr. Lodge) had recently made experiments on the influence of rapidly-rotating steel disks on the ether, which prove that the ether is not affected by the motion of contiguous matter to the extent of 1/200 part of the velocity of the matter. Thus, these two experiments are at present in conflict. Prof. Fitzgerald has suggested a way out of the difficulty by supposing the size of bodies to be a function of their velocity through the ether. Returning to the statements which have been made of Fresnel's law, Glazebrook has shown that actual extra-density of ether is not necessary, for, if the virtual mass be altered, the same results follow; all that is required is a term depending on the relative acceleration of ether and matter. To modern ideas the loading of the ether by the presence of matter is most likely to be correct, and the observed effects of relative motion are regarded as the results of secondary reactions of matter on ether. On this view, the ether of space may be wholly unaffected by the motion of matter. On the vortex ring theory of matter, it is not unnatural to suppose that the ether in its neighbourhood should be only affected irrotationally by its motion. And if the velocity potential be granted, nothing of the nature of viscosity being admissible, the results of all the interference, refraction, and aberration experiments could be predicted, and the whole theory is as simple as it can possibly be. The only trustworthy experiment ever made which tends against this view is that of Michelson. The author surmised that this must somehow be explained away. In reply to a question from Prof. Ayrton, Dr. Lodge said that when air was substituted for water in Fizeau's experiment no effect was observed. This might have been expected, for the difference in the times of journey by the two paths depended on $\frac{\mu^2-1}{\mu^2}$, and as μ is nearly unity for air, the air effect is too small to see. [In Hoek's interference experiment it might be said that the effect of ether moving in stationary water is balanced by that of the ether moving in stationary air; but while motion of water itself would disturb the balance, motion of air would do nothing appreciable. The only kind of motion that could display an optical effect is rotational motion, or motion of layers at different speeds, not a simple uniform drift. Prof. J. V. Jones asked how the Fizeau experiment could be expressed on the loaded ether theory; for, since the speed of matter affects the velocity of light, it seemed to involve a directional loading. A mere extra-density term, or acceleration coefficient, will not explain this; it seems to require a coefficient of a velocity term. This question has been hinted at by Lord Rayleigh, who points out (under the heading "Aberration," NATURE, xlv. p. 499) that the rate of propagation of waves on a loaded string will be affected by a travelling of its load. The question is not perfectly simple, and the analogy not complete. A good deal depends on the nature of the connection symbolized as "loading."[1]]

Royal Microscopical Society, May 18.—Dr. R. Braithwaite, President, in the chair.—Mr. R. T. Lewis, in his paper on the process of oviposition as observed in a species of cattle tick, said that the tick was observed under a low power; after some time the head with the extended rostrum and palpi was retracted, producing a deep depression, the softer adjacent portions of the ventral surface between the basal joints of the first pair of legs being drawn over the margin. Parts surrounding the depression changed colour, and a white vesicle appeared upon the lower internal wall. The palpi separated, so that they rested on each side of the vesicle. A membranous body, glistening with mucus, was protruded from the cavity, from the lateral extremities of which two papillæ were thrown out, extending across the depression. The vesicle was then elongated and embraced by the papillæ; through its walls an egg was seen in motion, which, being delivered into the grasp of the papillæ, the ovipositor at once retracted. The papillæ closed round the egg, covering it with an albuminous secretion, and withdrew, leaving it suspended from the under surface of the dorsal plate. The palpi closed together until in contact with the rostrum, the head elevating, clearing the egg out of the depression, leaving it adhering to the outer margin: the entire process of laying each egg occupying a period of 2 min. 42 sec. Mr. A. D. Michael remarked that the word "head" was somewhat misleading, because these animals had no heads in the sense in which the term applied to insects, but the whole movable organ was really the rostrum.—Mr. E. M. Nelson read a note on penetration in the microscope, showing that for his own sight the penetrating power was only one-seventh of that given by Prof. Abbe, whose myopic sight accounted for the difference in the estimate.—Mr. Nelson also read a note on rings and brushes of crystals, for the observing of which a petrological microscope was generally thought to be necessary. This was not essential, as it was really a telescopic object. All that had to be done was to convert the microscope into a telescope by placing an objective inside the tube of the instrument.

Geological Society, May 25.—W. H. Hudleston, F.R.S., President, in the chair.—The following communications were read:—On *Delphinognathus conocephalus* (Seeley) from the Middle Karoo Beds, Cape Colony, preserved in the South African Museum, Cape Town, by Prof. H. G. Seeley, F.R.S. The skull described in this paper is believed by Mr. T. Bain to have been collected by himself near Beaufort West. The preservation of the specimen leaves something to be desired, but notwithstanding defects the skull belongs to a most interesting Anomodont, indicating a new family of fossil Reptilia. The skull is fully described in the paper, and its relationships are discussed. The author has already given reasons for regarding *Ælurosaurus felinus*, *Lycosaurus curvimola*, and their allies, as referable to a suborder *Gennetotheria*, which is nearly related apparently to the *Pelycosauria*, and lies midway between the typical *Theriodontia* and the *Dicynodontia*. It is to this suborder that *Delphinognathus* may be referred, though it forms a family-type distinct from the *Ælurosauridæ*, distinguished by the conical parietal with a large foramen, the anterior supracondylar notch in the squamosal bone, and other modifications of the skull and teeth.—On further evidence of *Endothiodon bathystoma* (Owen) from Oude Kloof, in the Nieuwveldt Mountains, Cape Colony, by Prof. H. G. Seeley, F.R.S. Two bones found by Mr. T. Bain at Oude Kloof consist of the left ramus of the mandible and what the author regards as the left squamosal bone of *E. bathystoma*. The small cranial fragment preserved shows that the cerebral region probably conformed to the type of skull seen in some of the Dicynodonts. A description of the remains is given, and the author notices that the form of the articular condyle indicates a difference from *Dicynodontia* and all other *Anomodontia* hitherto described; it implies an oblique forward inclination of the quadrate bone—a character important in defining the suborder *Endothiodontia*. All the characters of the dentition of the animal suggest near affinity with the *Theriodontia*, especially the long lanceolate teeth strongly serrated.—On the discovery of Mammoth and other remains in Endsleigh Street, and on sections exposed in Endsleigh Gardens, Gordon Street, Gordon Square, and Tavistock Square, N.W., by Dr. Henry Hicks, F.R.S. In this paper the author gives a description of the deposits overlying the loam in which the remains of the Mammoth and other animals were found in Endsleigh Street, N.W. Under about six feet of made ground there was about ten feet of a yellowish-brown clay containing flints and much "race." Below the clay there was about five feet of sand and gravel, and under this about one foot of clayey loam, in which most of the bones were embedded. This loam contained many seeds, recognized by Mr. Clement Reid as being those of plants usually found in marshy places or ponds, and having a range at present from the Arctic Circle to the South of Europe. A list of the bones found is given by Mr. E. T. Newton, of the Museum of Practical Geology, Jermyn Street, who describes them as being those of one full-grown Mammoth, of another about half-grown, of the Red Deer, the fossil Horse, and of a small rodent. The author gives sections through Endsleigh Street and along the southern side of Endsleigh Gardens, and shows that where the bones were found there was a distinct valley in the London Clay, running in a direction nearly due north and south, the inclination of the valley being towards the north. The London Clay reached nearest to the surface towards St. Pancras Church and in Upper Woburn Place, the total thickness of the overlying deposits and the made ground there being only about 12 feet. Other sections, given along the southern sides of Tavistock and Gordon Squares, and through Gordon Street and the western side of Gordon Square, show varying thicknesses of the deposits, overlying the uneven floor of London Clay, of from 16 to 21 feet; the greatest thickness here is found at the north-western corner of Gordon Square. Seeds were also discovered in a loam near the bottom of Gordon Street, at the same horizon as that containing the mammalian remains, and some shells were found in a band of sandy clay, under a calcareous deposit, about half-way down the western side of Gordon Square. The author says that the deposits above the mammaliferous loam overlying the London Clay in this area cannot be classed as post-Glacial river-deposits, but must be considered as of Glacial origin. The animals, therefore, which evidently died on the old land-surface where their remains were found, lived there early in the Glacial period. The reading of this paper was followed by a discussion, in which the President, Mr. Monckton, Sir Henry Howorth, and the author took part.—The morphology of *Stephanoceras zigzag*, by S. S. Buckman.

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[1] Note by O. J. L.

Entomological Society, June 1.—R. McLachlan, F.R.S., Treasurer, in the chair.—The Hon. Walter Rothschild sent for exhibition *Neptis mimetica*, n.s., from Timor, mimicking *Andasena orope*, one of the Euplœidæ, and *Cynthia equicolor*, n.s., a species remarkable for the similarity of the two sexes, from the same locality; also a hybrid between *Saturnia carpini* and *S. pyri*, and specimens of *Callimorpha dominula*, var. *romanovii*, var. *italica*, and var. *donna*, bred by a collector at Zürich; he further exhibited a very large and interesting collection of Rhopalocera made by Mr. W. Doherty in Timor, Pura, Sumba, and other islands, during October and November 1891. Colonel Swinhoe remarked that the various species of *Neptis* were usually protected and imitated by other insects, and did not themselves mimic anything, and that the pattern of the *Neptis* in question was very common among the butterflies in the Timor group. Mr. Jenner Weir, Prof. Meldola, Mr. Trimen, and others continued the discussion.—M. A. Wailly exhibited fertile ova of *Trilocha varians*, which are arranged in small square cells, fastened together in large numbers, and present an appearance quite different from the usual type of Lepidopterous ova.—Mr. F. Merrifield exhibited a series of *Drepana falcataria*, half of which had been exposed for a week or two, in March or April, to a temperature of about 77°, and the other half had been allowed to emerge at the natural out-door temperature. The latter insects were in all cases darker than the former, all being equally healthy. Mr. McLachlan, Mr. Barrett, Mr. Jenner Weir, and others took part in the discussion which followed.—Mr. McLachlan called attention to the reappearance in large numbers of the Diamond-back Moth, *Plutella cruciferarum*, which was very abundant in gardens near London, and expressed his opinion that the moths had been bred in the country and had not immigrated.—Mr. Jenner Weir, Mr. Bower, and Prof. Meldola stated that they had recently seen specimens of *Colias edusa* in different localities near London.—The Hon. Walter Rothschild communicated a paper on two new species of *Pseudacræa*.

CAMBRIDGE.

Philosophical Society, May 30.—Prof. G. H. Darwin, President, in the chair.—The following communications were made:—The hypothesis of a liquid condition of the earth's interior considered in connection with Prof. Darwin's theory of the genesis of the moon, by Mr. Osmond Fisher. It was contended that a liquid condition of the earth's interior is not negatived by the existence of a semi-diurnal ocean tide, because it appears by calculation that a tide in an equatorial canal would in that case be diminished by only one-fifth of what its height would be upon a rigid earth. It was then recalled that all Prof. Darwin's numerical results in Table IV. of his paper on the precession of a viscous spheroid, as for instance that the moon was shed from the earth about 57 millions of years ago, depend upon the assumption of a certain high value for the internal viscosity, and will not hold good for a liquid interior. The total amount of heat, however, which must have been generated since that event, does not depend upon the viscosity, and will have been the same in the case of a liquid interior. This, if applied all at once, Prof. Darwin says, would raise the whole earth through 3000° F. if it had the specific heat of iron. Lord Kelvin holds that the earth is solid, and that it solidified in a short space of time, and that the matter of the interior at every depth is at the temperature of solidification for the pressure there. But if heat is being continually communicated to the interior, and chiefly to the more central regions, it seems impossible that the state of solidity supposed could be maintained. The author has shown in his "Physics of the Earth's Crust" that, if the crust is as thin as many geologists suppose, then there must exist convection currents in the interior, which prevent the crust from growing thick by melting off the bottom of it nearly as fast as it thickens. The central heat imparted to the interior by tidal action explains the maintenance of such currents. But the difficulty arises that the heat generated has been so great that there seems no obvious adequate mode of getting rid of it. The heat conducted away through the crust would not have been sufficient to reduce the mean temperature of the globe by more than about 209° F. in 100 million years from the first formation of a crust. Volcanic action on an extravagant estimate would help only to the extent of 4° or 5° F.; and the work of deformation of the crust would account for still less. It appears from the above that, if Prof. Darwin's theory is true, the solidification of the crust cannot have commenced until long after the birth of the moon; so that the still molten surface would be able for ages to radiate its heat directly into space. Otherwise we are thrown back on the nebular hypothesis, according to which the moon was left behind in the process of evolution of the system.—On Gynodiœcism in the Labiatæ, by Mr. J. C. Willis. Among the hermaphrodite flowers of *Origanum* and other Labiatæ, there occur (on the *same* plant) female flowers, and also flowers with one or more imperfect stamens; the corollas of these flowers are usually smaller than those of normal hermaphrodites. Their number varies from ·1 to 7·5 per cent. of the total flowers. Experiments conducted in 1891, to determine if these abnormalities varied in number with the season, gave no result; no two plants (though all were from one stock) gave similar results. Observations were also made on *Nepeta Glechoma*; the relative numbers of female and hermaphrodite flowers were determined weekly during the flowering season, and the proportion of females found to be greatest at the beginning of the season. It was also noticed that the female plants bear more open flowers at one time than the hermaphrodites (3·1 to 2·1). It was observed that the amount of protandry in the flowers appears to vary, being small at the beginning, and larger towards the end of the season. Further observations are in progress upon this subject.—On the steady motion and stability of dynamical systems, by Mr. A. B. Basset.—Note on the geometrical interpretation of the quaternion analysis, by Mr. J. Brill. The last two papers were taken as read.

DUBLIN.

Royal Dublin Society, May 18.—Dr. G. J. Stoney, F.R.S., Vice-President, in the chair.—Mr. G. H. Carpenter presented a report upon the Pycnogonida collected in Torres States by Prof. A. C. Haddon. The collection comprises only three species: *Pallene australiensis*, Hoek, for which (together with a new species) a new genus (*Parapallene*) is suggested; and a new *Ascorhynchus*.—Mr. H. H. Dixon gave a preliminary note on the mode of walking of some of the Arthropoda, illustrated by means of instantaneous photographs. He found that the limbs move together in "diagonals"; in insects the first and third legs on one side move with the second on the other; in spiders the first and third on one side with the second and fourth on the other; while the antenna of an insect is moved with the first leg on the same side.—Sir Howard Grubb, F.R.S., described his new chronograph for the Cape Town Observatory. This chronograph is built on the model of that at Dunsink Observatory, Dublin, with such improvements as have been suggested by recent developments in the clock-work of equatorial telescopes. The barrels, two in number, either or both of which can be brought into action, are 28 inches long and 9 inches in diameter. The screws which carry the wagons are one-tenth pitch, revolving once per minute. The circumference of the barrel being about 27 inches, the seconds are four-tenths of an inch long, and each barrel is available for about four and a half hours' work. The principal modifications upon the Dunsink instrument consist in the application of the electrical control of the clock, as described in the Proceedings of the Institution of Mechanical Engineers for the year 1888. The governor shaft of the clock gears directly into the driving spindle without any intermediate wheels, and as there is maintaining power to the clock barrel, it is possible to wind during the operation without at all affecting the rate of the clock. The axes of the barrels are supported upon sets of bicycle balls, in hardened steel boxes. The wagons carrying the electro-magnets for the registration of the signals are carried on one plain roller and two grooved rollers, the latter having hardened steel end-plates to insure accuracy of position. With the main instrument, which is inclosed in a glass case, is supplied a distributor for the purpose of working the electrical control, for the explanation of the action of which the above paper may be referred to.—On a new electrolytic galvanometer, by J. Joly. In the ordinary methods of determining the strength of a current by means of electro-chemical action, the element of time enters into the measurements, which further require considerable care in carrying out. In this instrument the observer is not concerned with time observations, and its indications follow fairly rapid variations of current. It consists of a glass bulb containing dilute sulphuric acid, in which are immersed platinum electrodes placed close together to diminish resistance. This vessel communicates below with a tube bent twice at right angles and carried up to a height of about 50 cm. above the level of the bulb. A little mercury contained in the bulb rises normally into this tube to a level which is the zero of the instrument. The tube is open at the top. The bulb is furnished with two tubulures on its upper surface. One is kept closed by a stopper, and merely serves to admit the electrolyte into the bulb when filling it. The other is furnished with a brass attachment upon which is cemented a small piece of platinum foil pierced by a hole of very small bore. The puncture is protected above and below from obstruction by receptacles containing cotton wool. When a current is passed between the electrodes the gas evolved can only escape through the fine puncture. At normal pressures this will only let the gas pass out slowly. Hence there is an accumulation of gas in the bulb, and the increased pressure causes the mercury to rise in the vertical index tube; but as the pressure rises, the rate of efflux of the gas increases till it equals the rate of evolution, when the mercury column comes to rest. The reading of a scale alongside the tube then gives the current in amperes. The instrument constructed for trial is very satisfactory. It reads on a very open scale up to 2·5 amperes. The electrodes are not large enough to carry heavier currents; if they were so, of course by enlarging the orifice the range could be increased. At the higher readings there is some delay before the mercury column becomes stationary, due probably to a rise of temperature in the bulb. There is probably some small variation of the readings with atmospheric temperature change. The calibration is effected by placing it in circuit with a trustworthy galvanometer. The inventor has had but little leisure to develop the instrument, and brings it before the Society in hopes that someone may think it worth while to further investigate its capabilities.

PARIS.

Academy of Sciences, June 7.—M. d'Abbadie in the chair.—On the application of M. Linstedt's method to the problem of three bodies, by M. H. Poincaré.—On a class of analytical functions of one variable dependent on two real arbitrary constants, by M. Emile Picard.—On the products of the residual life of the tissues, especially of the muscular tissue separated from the living being, by MM. Gautier and Landi (continued). The authors found that meat when kept at a temperature not exceeding that of the living animal, acquired an acidity of about 0·5 per cent. after several weeks, during which it was protected from air and bacteria. They attribute this acidity to the formation of acid phosphate of potassium under the influence of fatty acids, and especially to the partial peptonization of the albuminoids. Two substances, found in milk, but not in fresh meat, are also abundantly produced, viz. casein and nucleo-albumin. The albuminoids steadily decrease, whereas there is a proportional increase of alkaloids, these being identical with those produced during the life of the organism.—Effects produced upon numerous morbid states by subcutaneous injections of a liquid extract from the testicles, by M. Brown-Séquard.—On the densities of liquefied gases and their saturated vapours, and on the constants of the critical point of carbonic acid, by M. E. H. Amagat.—On new methods of forming certain substitution imides, by M. A. Haller.—Reports of the Committee charged with the examination of the calculator Inaudi, by MM. Charcot and Darboux. Jacques Inaudi, a peasant born in Piedmont in 1867, learned to reckon before he acquired the art of reading and writing, which he did not master till twenty. He therefore owes his extraordinary calculating powers to an abnormally developed memory for figures, aided by a mental representation of numbers which the Committee proved by a series of careful experiments to be purely acoustical, and quite independent of visualization. The rules of Inaudi's operations are original. In addition and subtraction he begins on the left side, and deals with each whole number in its turn. The extraction of roots and the solution of equations are performed by tentative approximations, executed with remarkable rapidity. At the end of a long sitting Inaudi was able to recount the whole series of numbers dealt with, amounting to some 400 figures.—On the stability of motion in a particular case of the problem of three bodies, by by M. Coculesco.—Solar observations during the first quarter of the year 1892, by M. Tacchini. At the Roman College, during this period, the frequency of metallic eruptions, spots, and faculæ was greater in the southern hemisphere of the sun, whereas the protuberances were more frequent in the northern, and nearer the pole. The auroral maximum is probably more dependent on that of the protuberances than that of the sun-spots.—On a property common to three groups of two polygons, inscribed, circumscribed, or conjugate to one conic, by M. Paul Serret.—On discontinuous groups of non-linear substitutions with one variable, by M. Paul Painlevé.—On the acceleration of mortality in France, by M. Delauney. From a calculation based upon certain tables published by the Bureau des Longitudes, it appears that the death-rate is accelerated during the ages ranging from 16 to 32 and 54 to 82, while it is retarded between 1 and 16, 32 and 54, and after 82. This gives the numbers 16, 32, 54, and 82, which may be regarded as natural epochs of human life. They may be derived from the equation $3x^2 - 5x + 4$, by substituting for x the values 3, 4, 5, and 6. The equation represents a parabola.—Optical method of determining the conductivity of metallic bars, by M. Alphonse Berget. This is based upon an application of interference fringes or Newton's rings produced at the ends of two bars to be compared, by means of which the ratio of their elongations is found. Applicable to bars of rare metals.—On the propagation of heat within crystallized substances, by M. Ed. Jannettaz.—On a new determination of the ratio v between the electro-magnetic and the electrostatic C.G.S. units, by M. H. Abraham. Obtained by measuring the same capacity—of a plane condenser with guard ring—in both systems. The value obtained for v was $299{\cdot}2 \times 10^8$.—On the basic nitrates of zinc, by M. J. Riban.—On the permolybdates, by M. E. Péchard.—On a reproduction of leucite, by M. A. Duboin.—Contributions to the study of mineral waters: preservation of these waters, by M. P. Parmentier.—On the fixation of iodine by starch, by M. Gaston Rouvier.—Mechanical determination of the boiling-points of alcohols and acids, by M. G. Hinrichs.—Preparation and heat of formation of monosodic resorcin and hydroquinone, by M. de Forcrand.—Thermal study of the dibasic organic acids: methyl-malonic and methyl-succinic acids; influence of isomerism, by M. G. Massol.—On an oxidation product of starch, by M. P. Petit.—Organo-metallic combinations of the aromatic acetones, by MM. E. Louise and Perrier.—On the chlorine derivatives of the isobutylamines, by M. A. Berg.—Researches on the ptomaïnes in some infectious diseases, by M. A. B. Griffiths.—On the dioptase of the French Congo, by M. E. Lacroix.—Researches on the filtration of water by the Mollusca, and applications to ostreiculture and oceanography, by M. H. Viallanes.—On a parasite of the locusts, by M. L. Trabut.—Tuberculous vaccination of dogs, by MM. Héricourt and Ch. Richet. The effect was tried of vaccinating some dogs with aviary tuberculosis, which proved a perfect prophylactic to human tuberculosis, the injection of which proved fatal to those not so vaccinated, the rest being unaffected.

BERLIN.

Physiological Society, May 13.—Prof. Munk, President, in the chair.—Prof. Loewy gave an account of experiments on respiration under reduced atmospheric pressure, carried out in a confined space which admitted of very rapid reductions of pressure (to half an atmosphere) with constant composition of the inclosed air. The amount of reduction which was borne without ill effects differed in the case of the three persons on whom the experiments were made, in accordance with the magnitude of their respiratory activities: the greater the latter, the greater was the reduced pressure which could be withstood. For any one person it appeared that a greater reduction could be borne while fasting or during work than after a meal or during repose. Both oxygen and carbon dioxide were found to do away with the discomfort resulting from over rarefaction of the air. Slightly reduced pressure had no effect on respiratory interchange, while if the reduction was considerable, more carbon dioxide was expired, notwithstanding the diminished supply of oxygen. The reduced pressure of the latter gas was found to act on the respiratory mechanism in such a way as to lead to deeper, and hence compensatory, respiratory movements.—Dr. Wertheim spoke on the blood-vessels of the avian eye in both the embryonic and fully developed state, illustrating his remarks by injected specimens of embryonic eyes.

Physical Society, May 20.—Prof. Lampe, President, in the chair.—Prof. Neesen gave an account of his researches on the motion of loose disks centred on an axis rotating at high speeds. The disks were of varying mass and moment of inertia, and had at one side an excentrically-placed pin, in order that the least weight might be determined which, when applied to this pin, stopped the rotation of the disk. The necessary weight, as thus measured, was found to vary with the rotational velocity of the axis and with the mass and moment of inertia of the disk. It varied also according as the axis was dry or smeared with old or new oil, and also with the material of which the disk was made, &c.—Dr. Wien spoke on Maxwell's electro-magnetic theory, and the additions made to it by Poynting, and gave, in conclusion, a hypothetical conception of the nature of magnetism which corresponded to the existing formulæ.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Books.—Notes and Queries on Anthropology, second edition: edited by J. G. Garson and C. H. Read (Anthropological Institute).—The Birds of the Sandwich Islands, Part 3: S. B. Wilson and A. H. Evans, (Porter).—Irrigation and Water Storage in the Arid Regions; Letter from the Secretary of War (Washington).—Die Grundzüge der Theorie der Statistik: Prof. H. Westergaard (Jena, Fischer).—Die Bewegung der lebendigen Substanz: M. Verworn (Jena, Fischer).—Ostwald's Klassiker der Exakten Wissenschaften, Nos. 1 to 30 (Leipzig, Engelmann).—The Threshold of Science, second edition: Dr. C. R. A. Wright (Griffin).—Untersuchungen über mikroskopische Schäume und das Protoplasma: O. Bütschli (Leipzig, Engelmann).—Die Epiglottis: C. Gegenbaur (Leipzig, Engelmann).—Jethou, or Crusoe Life in the Channel Islands: E. R. Suffling (Jarrold).—Six Botanical Diagrams (S.P.C.K.).—Essays upon Heredity and Kindred Biological Subjects: Dr. A. Weismann; edited by E. B. Poulton and A. E. Shipley; vol. ii. (Oxford, Clarendon Press).

Pamphlets.—Present Problems in Evolution and Heredity: Prof. H. F. Osborn.—Church and State in Early Maryland: Dr. G. Petrie (Baltimore).

Serials.—Journal of the Marine Biological Association, vol. ii., No. 3 (Dulau.)—Proceedings of the American Philosophical Society, vol. xxx., No. 137 (Philadelphia).—Proceedings of the Academy of Natural Sciences, Philadelphia, 1892, Part i. (Philadelphia).—Transactions of the Leicester Literary and Philosophical Society, April (Leicester).—Rendiconto dell' Accademia delle Scienze Fisiche e Matematiche, January to March (Napoli).—Proceedings of the Royal Society of Victoria, vol. iv. (new series), Part i. (Williams and Norgate).

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